

REMARKS

This is in response to the Office Action dated December 27, 2010. Claims 4-34 are pending and stand rejected in the outstanding Office Action. No claims have been amended herein.

The rejection of claim 4 under 35 U.S.C. § 103(a), as allegedly being unpatentable over Kawasaki et al. (US 2003/0047785) in view of Goodman (US 4,204,217) and further in view of Yan et al. (US 2003/0218222), Vijayakumar et al. (US 4,751,149) and Wager et al. (US 2003/0218222), is respectfully traversed.

The cited prior art does not teach or suggest an active layer including intentionally added nitrogen and hydrogen dopants having concentrations so that a threshold voltage of a gate voltage of the semiconductor device is controlled to be substantially in a range between 0V and 3V

In response to Applicant's argument filed with the Response of November 11, 2010, that nowhere in Vijayakumar is there a teaching that the value of the threshold voltage is being controlled by the hydrogen dopants, the Examiner stated that this argument attacks an individual reference, Vijayakumar, whereas the prior art rejections were based on a combination of references. Moreover, the Examiner stated that "Applicants do not specifically claim a correlation between concentrations of intentionally added dopants and a threshold voltage", see pp. 13-14 of the Final Office Action of December 27, 2010.

Even though, Vijayakumar is only one of a combination of prior art references used in rejecting claims 4 and 5, however, Vijayakumar was cited specifically for the teaching of an added hydrogen dopant, and neither Vijayakumar or any of the other references teaches the claimed limitation that the added hydrogen has a concentration chosen to control the threshold

voltage. Moreover, unlike the Examiner's assertion, claim 4 does recite specifically a correlation between concentrations of intentionally added dopants and a threshold voltage, "said active layer includes said nitrogen and hydrogen as intentionally added dopants *having concentrations so that a threshold voltage of a gate voltage of the semiconductor device, when a voltage between a drain and a source region is fixed at 10V, is controlled to be substantially in a range between 0V and 3V*", emphasis added.

In response to Applicant's argument that Wager does not teach that the doping concentration of nitrogen is chosen to control the threshold voltage, but rather for enhancing the resistivity of the ZnO layer, the Examiner stated that this argument appears to suggest that there should be a specific and exact teaching in the prior art of the correlation between concentrations of intentionally added dopants and a threshold voltage even when the threshold voltage depends on a lot of other device parameters and that the concentrations of intentionally added dopants are the only parameters that would determine the recited threshold voltage, whereas specific ranges for the concentrations of the intentionally added dopants have not been claimed. The Examiner stated that "Applicants cannot claim an intention to achieve a desired threshold voltage *only* by controlling the concentrations of intentionally added dopants without claiming other critical and essential parameters in the practices of the invention such as a channel layer thickness and a gate insulating layer thickness, etc.", emphasis added, see p. 15 of the Final Office Action.

The Examiner has not met his burden for providing a factual basis for his assertion that the cited prior art teaches intentionally adding nitrogen and hydrogen having concentrations so that the threshold voltage lies within the claimed range. The fact that other parameters may also affect the threshold voltage is irrelevant, since neither Wager nor Vijayakumar teaches explicitly

or implicitly that added nitrogen or hydrogen should be added in concentrations so that the threshold voltage is controlled, let alone be within the claimed range of 0V to 3V.

Responding to Applicant's argument that the cited prior art teachings would not have made it obvious to intentionally add nitrogen and hydrogen dopants with appropriate concentrations so that the threshold voltage is in the claimed range, the Examiner stated that 1) applicants acknowledge that Wager discloses a threshold value within the claimed range and 2) that controlling a threshold voltage of a field effect transistor is well known in the art.

First, even though Wager may teach a range for the threshold voltage within 1V-20V, however, the device of Wager is different than the claimed device, since Wager's device lacks a protective layer. The threshold voltage of a TFT having a protective layer is a lot different from that of a TFT without a protective layer, see p. 4 of Applicant's Response of November 11, 2010. It was the unexpected result of the inventors' work that showed that a TFT with a protective layer can have its threshold voltage within the practical range of 0V-3V, by controlling the concentrations of the nitrogen and hydrogen dopants. Even though, controlling the threshold voltage of a field effect transistor may be well known in the art, the correlation between the concentrations of the intentionally added nitrogen and hydrogen and the claimed range for the threshold voltage in the claimed device with a cover was not known.

Finally, in response to Applicant's argument that the nitrogen and hydrogen have concentrations so that threshold voltage is in a practical range of 0V to 3V, which is away from the expected range of large negative values, around -30V, the Examiner stated that "it appears that Applicant's arguments may be true for certain device parameters such as dimensions of the field effect transistor or concentrations of intentionally added dopants, but may not be applied to in general with Wager providing a counterexample", see p. 17 of the Final Office Action.

Again, Wager's device lacks a protective cover, so it cannot be compared with the inventive device of claim 4. Moreover, the fact that the claimed range for the threshold may be associated with certain device parameters does not negate the fact that the concentrations of the added nitrogen and hydrogen cause the voltage threshold to lie in the claimed range of 0V to 3V (which is not taught or suggested by the cited prior art).

However, following the Examiner's useful suggestion, see bottom of p. 16 of the Final Office Action, Applicant has filed herein a Rule 132 Declaration (by one of the inventors) that explains how the concentrations of the added nitrogen and hydrogen may be chosen so that the threshold voltage can be brought down to a more practical range even for a device which has a protective cover, thus providing evidence for unexpected results relative to prior art ranges.

For the above reasons, claim 4 is allowable.

It is respectfully requested that the rejection of claims 5-34, each one dependent from claim 4, also be withdrawn.

In view of the foregoing and other considerations, all claims are deemed in condition for allowance. A formal indication of allowability is earnestly solicited.

The Commissioner is authorized to charge the undersigned's deposit account #14-1140 in whatever amount is necessary for entry of these papers and the continued pendency of the captioned application.

Should the Examiner feel that an interview with the undersigned would facilitate allowance of this application, the Examiner is encouraged to contact the undersigned.

Respectfully submitted,

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